FEEDING DAIRY CATTLE HOME-GROWN FEEDS FOR PROFIT

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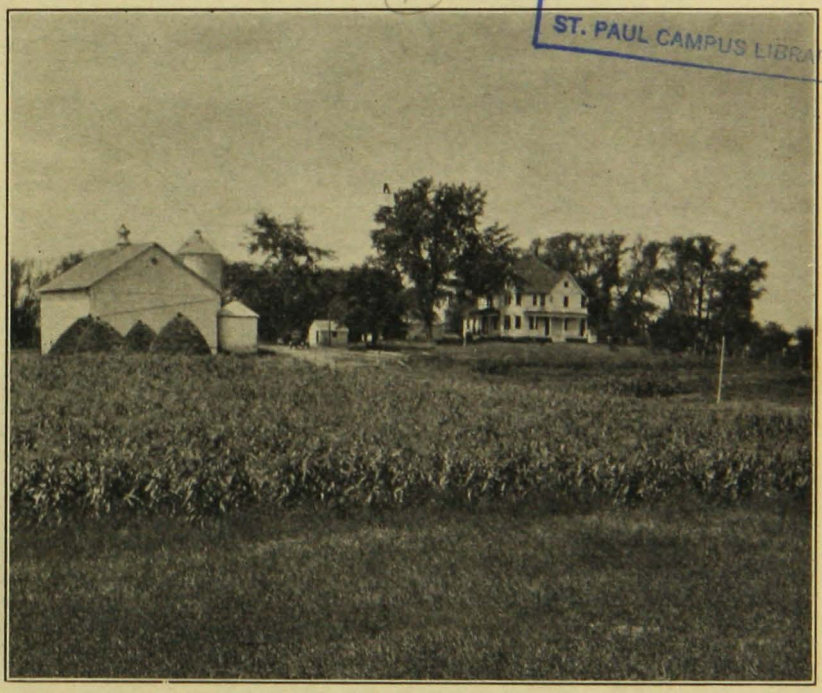

Alfalfa, Silage, and Grain, the Basis of All Successful Rations for the Dairy Herd

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INTRODUCTION

Because of the ever persistent demand for circulars containing practical information regarding the feeding of dairy cattle home grown feeds, this pamphlet is prepared and circulated with the idea in mind of dealing, in as brief as possible a manner, with the practical fundamentals of feeding home grown feeds for profit.

Minnesota's progress along dairy marketing lines has far advanced over the average Minnesota cow from a production standpoint. Splendid creameries are operating on a quality basis, are marketing their product wisely through the proper channel and paying top prices to their patrons. Many of these same farmers, although receiving a good price, are losing money every day they keep their cows. When one considers the time spent on a cow during the year, regardless of modern equipment reducing the effort, if this cow returns a loss at the end of the year drastic steps should be taken to correct the fault.

In the first place a cow must be bred for dairy production. By this is meant coming of a line of ancestry which represents the type and quality necessary for economical production of dairy products. Our approved dairy breeds have been developed along these lines, and grade cows sired by good purebred dairy bulls of proven ancestry, are easily obtained.

CAREFUL ATTENTION MUST BE GIVEN THE COW'S PHYSICAL NEEDS

Feeding this cow, then, is the next important step. Too often the serious mistake is made of not realizing the average cow's capacity for handling feed and her peculiar adaptability to her natural rations. Nature's ideal feed for the dairy cow is grass. Our problem, then, is to substitute as far as possible under artificial conditions those feeds which most nearly resemble grass. Why is she particularly adapted to grass? Grass is a bulky succulent feed with its nutrients in the proper balance or proportions. The average 1000-pound cow has a large four-compartment stomach of from 30 to 45 gallon capacity. The large compartment or paunch carries on no digestion but simply acts as a storeroom while the cow is grazing. Once she is filled up, she has the ability to bring back to the mouth portions of this stored up feed, or in other words, "chew her cud." After the "cud" is chewed it passes into the second, third, and fourth stomachs, respectively, where it is mixed with digestive juices and some absorption of nutrients takes place.

In order for the cow to maintain a healthy digestive condition her feed must be adapted to her physical make-up. It is clearly understood then why grass with its bulk and high water content is adapted to the large compartments of the cow's stomach and aids in its necessary peristalsis, or rolling motion.

With knowledge of the cow's adaptability to her natural feed a study of the uses of its contained nutrients is necessary. Listed in their order of use they are as follows:

1. Maintenance of life
2. Growth
3. Development of fetus (calf being carried by cow)
4. Body fat
5. Milk production

In practically all cases 1, 2, 3 will be taken care of before 4 and 5, altho in some cases heifers capable of high production, freshening early, will give milk at the expense of continued growth.

Profit is determined by the amount of feed a cow will eat and use for milk production over and above that needed for the body.

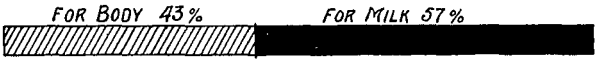
A good cow fed only enough feed for 150 pounds of fat in a year uses her feed like this.

For body 60 per cent For milk 40 per cent

Less than half the feed is used for milk production.

Fed a little more to produce 300 pounds of fat, she uses it this way:

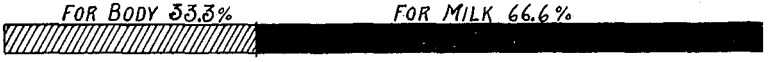
For body 43 per cent For milk 57 per cent



A little over half the feed is used for milk production.

Fed still more to produce 450 pounds of fat, she uses it this way:

For body 33.3 per cent For milk 66.6 per cent



Two thirds of the feed is used for milk production.

The larger the production, the smaller the percentage of feed that is wasted for body maintenance.

In maintenance of body the following constituents of the body must be replenished:

1. Skeleton
2. Muscles—tendons
3. Hair, horn, hoofs
4. Water
5. Blood
6. Minerals throughout system other than skeleton.

The following compounds are necessary to rebuild the body parts given above:

1. Lime—phosphorus
2. Proteins—carbohydrates, fats
3. Proteins
4. Water
5. Protein, water, phosphorus, other minerals.

Perhaps the outstanding feature in existing conditions today is the evidence of a lack of sufficient supply of the above having been given the average cow illustrated chiefly by:

Lack of size attained by average cow

Low average butterfat and milk production

That not enough feed, almost regardless of its proper balance and constituents, is fed the average cow in order to satisfy her capacity is ably illustrated, as stated previously, with regard to lack of size in our average cow. Cow testing associations with their inevitable influence toward better feeding methods have proved in countless cases the ability of a cow to consume more feed and in turn produce beyond the anticipation of her owner. The following illustrates the above in a clear cut concise manner:

In September 1923 four cows were purchased by the University of Minnesota from a herd which had the lowest average in the local cow testing association. They had been fed timothy hay and purchased feeds—bran, shorts, molasses feed, and oilmeal. In the University Farm herd they were fed silage, alfalfa, corn, oats, and barley according to production which increased their average butterfat production 77 pounds. When purchased from their owner the cows were thin and consequently the University Farm home grown ration did not have a real chance. This year they have all had a good rest, are in good flesh at freshening time, and the one cow having freshened to date is exceeding her last year's daily production by 5 to 10 pounds of milk on the same feed.

CHART I

WINTER RATION FED ON ORIGINAL OWNER'S FARM

Roughage	
Timothy hay*	
Grain mixture† (all purchased)	
Bran	90 parts
Middlings	80 parts
Molo feed	18 parts
Oilmeal	4 parts

* Fed 23 pounds per day.

† Fed 5 pounds per day. Cows on pasture 6 months.

CHART II

RATION FED AT UNIVERSITY FARM

Roughage	
Corn silage	
Alfalfa hay	
Grain mixture* (all home grown)	
Oats	2 parts
Corn	1 part
Barley	1 part

* Fed according to production. Cows on pasture 5 months.

SUMMARY OF PRODUCTION OF THE FOUR COWS AT UNIVERSITY FARM COMPARED WITH PRODUCTION OF THE SAME COWS ON ORIGINAL OWNER'S FARM

	On original owners' farm	At University Farm	Increase	Increase
				Per cent
Average milk per cow	4,662 lbs.	6,375 lbs.	1,713 lbs.	36.7
Average fat per cow	182 lbs.	259 lbs.	77 lbs.	42.3
Value of product per cow	$87.36	$124.32	$36.96	42.3
Average feed cost	$49.46	$61.42	$11.96	24.1
Returns over feed cost per cow	$37.90	$62.90	$25.00	60.6

Regardless of how well a cow is fed after freshening a loss will be incurred if she came in, in poor condition. If possible a six weeks' to two months' rest should be given at which time feeds should be high in energy value. Starchy feeds such as corn, oats, barley, etc., should be fed in preference to those high in protein because of the fattening effect of the former. A good cow after freshening literally milks off her body and consequently in order to insure high and persistent production her reserve must be built up when dry. The most advantageous way to do this is to have her dry on good pasture. Minerals are

more readily assimilated from good pasture than from commercial feeds. Good and abundant pasture is necessary and if such is not available a liberal supply of legume hays plus a small amount of grain is advisable. Many a cheap pound of butterfat is put on the cow when dry.

As has been stated previously, the practical angle from which to approach the fundamentals of successful feeding is to consider first the cow's adaptability to her natural feed and in turn its constituents and properties with relation to their ability to supply the needs of the cow stated above. They are as follows:

1. Bulk (so necessary because of cow's great capacity)
2. Succulent, 50 to 90 per cent water
    a. Aids in digestion
    b. Carries off waste materials
    c. Furnishes water for milk production (milk is 87.5 per cent water)
    d. Carries nutrients in body tissues
3. Furnishes sufficient protein
4. Furnishes sufficient carbohydrates and fats
5. Furnishes sufficient minerals in most available form
6. Is palatable and encourages cow to eat readily

We have been discussing grass as pertaining to pasture and our problem now deals with:

1. Too short a pasture season
2. Insufficient abundance to satisfy cow's capacity under most conditions.

The most practical substitute for good grass pasture is a combination of succulent roughages and legume roughages as given below:

1. Succulent roughages—Corn or sunflower silage, roots, potatoes
    a. Furnishes bulk
    b. Furnishes water, 75 to 90 per cent
    c. Furnishes starch (carbohydrates and fats)
    d. Are not protein feeds
    e. Increases appetite for other feed
2. Legume roughages
    a. Alfalfa 10 to 12 per cent protein, 1 pound alfalfa equals 1 pound bran (high in mineral matter—lime and phosphorus)
    b. Clover (red or alsike) 7 to 10 per cent protein
    c. Sweet clover 10 to 12 per cent protein
    d. Oat and pea hay 5 to 7 per cent protein
    e. Soybean hay 10 to 11 per cent protein.

From this it is readily seen that Minnesota dairymen are in a splendid position to furnish the best of roughages or foundation feeds for their cows because of the state's adaptability to the growing of roots, silage, and legumes. The above combination should be self-fed or the cow allowed all she will clean up because of its harmless physical effect under most conditions and because it is the cheapest source of succulence, protein, and mineral. In addition to the physical value, it furnishes its nutrients in abundant form in the case of protein and minerals.

Alfalfa and clover contribute two or three times more protein and mineral than wild and timothy hay. In order to compensate for lack of protein in poor roughages a cash outlay is necessary in the form of oilmeal, cottonseed, etc. The more that high priced purchased concentrated protein is necessary the smaller the profit.

To what extent will the above roughages, namely, alfalfa or clover and silage or roots, furnish sufficient nutrients for maintenance and milk production?

A 1000-pound cow needs for one day's maintenance .7 pound protein and 7.93 pounds total nutrients. By total nutrients is meant protein, carbohydrates, plus 2¼ times the fats. (The fats are simply stored up carbohydrates in a concentrated form and one pound of fat is considered as having 2¼ times the energy value of one pound of carbohydrates.) Subtracting .7 pound protein from the 7.93 pounds total nutrients, or the protein from the total nutrients in which it is included, gives a nutritive ratio of 1:10 for maintenance or 1 pound protein for every 10 pounds carbohydrates. Consider the 1000-pound cow self-fed alfalfa and corn silage. She will usually eat:

10 pounds alfalfa at 10% protein equals	1.00 lb. protein—	6.5 lbs. total nutrients
30 pounds silage at 1.1% protein equals	.33 lb. protein—	5.3 lbs. total nutrients
	1.33 lbs. protein	11.8 lbs. total nutrients

Subtracting the maintenance requirement we find:

1.3 lbs.	11.8 lbs.	
.7	7.93	
.6	3.87	total nutrients which may be used for purposes other than maintenance.

It must be understood that these figures are not to be applied as accurate in cases of individual cows but as a guide to the feeding of the average cow as a result of years' of investigation. For every pound of 4 per cent milk produced this cow will need .054 pound additional protein and .346 pound total nutrients over and above that required for maintenance. Theoretically then for 20 pounds of 4 per cent milk she will require 1.2 pounds protein and 6.92 pounds total nutrients. As her alfalfa and silage will not furnish this plus maintenance, additional feed is required.

Remaining with home grown feeds we find:

	Protein Lbs.	Total Nutrients Lbs.
Ground oats, 4 pounds	.39	2.82
Ground barley or corn, 4 pounds	.30	3.43
	.69	6.25
Furnished by roughages	1.3	11.80
	1.99	18.05

Subtracting the required nutrients this ration is found to furnish theoretically the correct amount of protein and total nutrients. Feeding 1 pound grain of this mixture to 3 pounds of 4 per cent milk the increased nutrients necessary to supply up to 30 pounds milk can for the most part be taken care of by feeding more grain. After the 30-pound point is reached and because of the demand for .06 pound protein for each pound of milk it will perhaps be necessary to add feeds high in protein to the grain ration because of the cow's inability to further consume bulk.

It will be remembered that the maintenance requirement of a 1000-pound cow called for 1 pound protein and 10 pounds carbohydrates and fats. For the production of 1 pound of 4 per cent milk .06 pound protein is required and .286 pound carbohydrates or 1 pound protein to 4.7 pounds carbohydrates. These are nutritive ratios or the proportions of nutrients in a feed. The maintenance ratio

is "wide" and the one for milk, "narrow." The wide ration is one high in carbohydrates and those higher in proportion in protein are designated as narrow.

It is a well-known fact that high production is maintained on a comparatively narrow ration at least for a short period. The carbohydrates for maintenance and energy in this case must be stored up in the body of the cow before freshening and the narrow ration high in protein has a tendency to furnish the .06 pound of the latter necessary for each pound of milk.

It is not the purpose of this pamphlet to deal with individual high record cows, but to encourage more systematic and economical feeding of home grown feeds to the general herd in the interests of high average herd production. Most authorities believe in a conservative nutritive ratio of 1:5.5 to 1:6 varied according to condition of the cow or her producing ability.

Previously it was stated that alfalfa and silage, self-fed, plus oats and corn or oats and barley, equal parts, and fed 1 pound to 3 pounds of milk will under average conditions satisfy the 1000-pound cow producing 20 pounds of milk. The same ration will probably supply her needs for between 25 and 30 pounds of milk, but beyond that more protein must be added to furnish the protein requirement in additional milk. This may be supplied through linseed oilmeal, cottonseed meal, bran, gluten feed, or ground soybeans. Linseed oilmeal and ground soybeans are to be preferred as they have practically equal feeding values and are highly palatable. Oilmeal is more laxative. Soybeans can be grown on most Minnesota farms today with a yield of 10 to 20 bushels per acre containing 30 per cent protein.

Thus it is seen that with the exception of variety the essential requirements of a good ration are easily found in our own home grown feeds and are desirable in the case of individual high producing cows.

Corn and barley are interchangeable pound for pound and are high in starch or energy value. Oats is more nearly balanced in nutrients and, as a result, is a splendid feed for young stock; when ground it adds bulk to the grain ration. Bran is interchangeable with alfalfa pound for pound. Consequently the dairyman with alfalfa can better afford to feed this roughage to his general herd than bran. Bran, however, is laxative and lightens an otherwise heavy grain ration for the heavy milking cow. It is invaluable as a single feed or tonic for the freshening cow.

MINERALS

A. Salt

Not home grown but indispensable. Cows need salt in proportion to milk production. It furnishes many essential minerals and should be available at all times.

B. Other minerals, i.e., calcium, phosphorus, and iodine.

In most instances where legumes are fed in abundance and especially in sections where the soil is not deficient in lime and phosphorus there is little necessity to worry about lack of minerals. However, in some sections this deficiency does exist and in case legumes are not being fed the poorer roughages will not furnish sufficient minerals. It is estimated experimentally that a milking cow gives to her milk approximately one third of her skeleton during a lactation period. This must be replaced and is best accomplished by the cow when dry and on good pasture.

Mineral mixtures containing lime, salt, phosphorus, and potassium iodide are on the market and can be fed advantageously to the herd. This mixture is expensive, however, and is not needed by the entire herd. It is best fed in a protected box in the exercise lot or in small cups or boxes in the manger where

the animal can help herself. Mixing with the general herd ration is wasteful (as is the feeding of high-priced protein concentrates such as oilmeal to the dry cow).

A good home mixture can be made with 100 pounds of finely ground bone meal and 25 pounds of salt.

Potassium iodide is fed as a preventive of goiter in calves. Minnesota is in an iodine-deficient area and goiter in calves is not uncommon. Two grains of potassium iodide per day in the feed or water for a period of six months during pregnancy is considered sufficient prevention against goiter.

Below will be found rations which may suit particular needs. They are balanced according to nutrients contained and, for the most part, consist of home grown feeds. Also notice the tables giving the common commercial feeds and their digestible nutrient content which will aid in formulating rations in individual cases.

In the event that home grown grains are not at hand or are too high in price to compete with mill by-products the problem of substituting these by-products for home grown grains will be assisted, no doubt, in the following discussion of our common concentrates.

PHYSICAL AND NUTRITIVE VALUE OF HOME GROWN AND PURCHASED FEEDS

Corn.—This grain forms a major part of all livestock rations throughout the Middle West. It is high in carbohydrates and is known as a heating or fattening feed. Its protein content ranges from 8 to 9 per cent depending on its maturity. Corn should not be fed on the cob to dairy cows but the kernels should be ground, altho it is not necessary that it be very fine. Corn and cob meal sometimes is fed to advantage if bulk is desired, but not otherwise. Corn plays an important part in fitting the dry cow for her next lactation and in the ration of the heavy milker furnishes heat and energy so necessary during cold weather.

Barley.—In the dairy cow's ration barley is on a practical basis equal pound for pound with corn. It is not quite as palatable as corn and to get desirable results it is fed to best advantage with other feeds as oats, bran, and corn. Barley has a tendency to be pasty and when too finely ground is liable to cause digestive disorders unless fed with other bulky feed. It is also high in energy as is corn and practically 1 per cent higher in protein or 9 per cent.

Oats.—The world over there is no better grain for livestock than oats. The baby calf and colt will take kindly to oats as their first grain. It is the most nearly balanced as to nutrients of any of our grains and is fairly high in mineral, being considered among farmers what is known as a bone and muscle builder.

In addition to its qualities in a nutritive way, it is very light and bulky when ground; this factor makes the use of oats advantageous in mixing with corn and barley.

Speltz.—This grain, grown in several sections in the Northwest, occasions questions as to its feeding value. It is considered about on a par with barley and should be fed in the same manner.

Ground flax.—As a food this grain is very laxative and contains 20 per cent protein and may be fed in the grain ration up to one pound per day as far as physical effects are concerned but the 29 per cent fat content limits further use over an extended period.

The prevailing price of flax makes it prohibitive as a feed, and oilmeal, which is higher in protein by 10 per cent and more palatable, is a better proposition.

Ground soybeans.—The farmer who has a supply of these on hand is fortunate. They are equally as palatable as oilmeal, are practically as high in protein, containing 29 per cent, and are high in fat which is readily assimilated by the cow. Up to 2½ to 3 pounds may be fed, and, if the price is low enough on seed to warrant their feeding, ground beans serve a great need in the ration.

Wheat.—This makes a splendid feed when grown with oats as succotash and ground together, however it is too high in price this season. Shrunken wheat is high in protein and will more than replace middlings.

Wheat middlings.—As a mill by-product it is high in total nutrients containing 14 to 16 per cent protein and should be considered a substitute for corn or barley. It serves a better purpose in the grain ration than corn or barley when poor quality roughages are fed, by adding 5 to 6 per cent more protein pound for pound. Middlings are pasty and are not palatable when fed alone. It should constitute one-third part of a ration including oats and bran. When fed with bran alone equal parts by weight is advisable.

Bran.—No better tonic can be given shelter in the barn; it is light, palatable, laxative, contains 10 to 12 per cent protein, and is high in phosphorus. It is a substitute for alfalfa and oats. It has no equal in lightening up a heavy corn, oats, and barley ration and at the same time aids in maintaining health. The question is often asked which is the better choice, oats at 35 cents per bushel or bran at $28 per ton? Oats is cheaper but at the price it is advisable to add bran to the ration especially if the hay is poor.

Oilmeal.—This feed is generally conceded our standard high protein concentrate. It is palatable and contains 33 per cent protein, and is also high in phosphorus. It is very laxative and should be fed in limited quantities, according to the protein roughages available, usually from ½ to 2 pounds per day according to production.

Cottonseed meal.—This meal is not commonly used except in rations of test cows. It contains up to 37 per cent protein but is not as palatable as oilmeal or soybeans and is binding rather than laxative. Cottonseed meal should only be fed when succulence is available.

Gluten meal.—The germ of corn is used in making this palatable meal which is 29 per cent protein content. It may be fed like oilmeal.

Molasses.—One quart of molasses dissolved in 10 to 12 quarts of warm water makes a splendid appetizer when mixed with grain or coarse roughage. Oftentimes the molasses is fed straight with the grain to the extent of one quart on each feeding of grain. This is practical only in the case of encouraging high production in test cows. The food value of molasses is confined largely to its carbohydrate content.

Prepared feed mixtures.—These are on the market and are acceptable when home grown grains, plus bran and oilmeal, are not to be had. They are higher in protein content than the average farm mixture and as a result are often used to splendid advantage in localities short on home grown feeds, especially those high in protein. In purchasing any feed attention should be given to its protein and total nutrient content with an eye as to what may constitute its crude fiber make-up. Prepared rations are usually very palatable. They are balanced well as to nutrients and are valuable in the interests of the inexperienced feeder. The price of the ingredients used should be a guide.

From the material already given it is easy to understand that practical feeding means economy. Feeds grown on the home farm should be used as far

as possible. Equal parts corn and oats or barley and oats are sufficient for cows producing less than 25 pounds Jersey or Guernsey milk per day or less than 30 pounds Holstein. When feeding over 8 to 10 pounds of this mixture one-third bran should be added. Oilmeal or ground soybeans in the ration to the extent of ½ pound to every 5 pounds of Guernsey or Jersey milk above 25 pounds and every 5 pounds above 30 pounds of Holstein. Oilmeal is most economically fed separately as, mixing with the herd ration and fed alike to all cattle wastes money in many instances.

For convenience the following rations have been prepared which will serve as a guide in feeding. These rations are not intended for cows on test, making large records, but for good average production.

RATION NO. I

Nutritive ratio 1:6.6

	Lbs.	
Silage	30	Daily roughage
Clover hay	12	
Corn, ground	300	Feed one pound of this mixture for every 3 to 4 pounds of milk produced
Oats, ground	300	
Bran	300	
Ground soybeans or Linseed meal	100	

RATION NO. II

Nutritive ratio 1:6.7

	Lbs.	
Silage	35	Daily roughage
Clover hay	12	
Corn and cob meal	300	Feed mixture according to production
Oats, ground	100	
Gluten feed	100	

RATIO NO. III

Nutritive ratio 1:6 suggested where silage is not fed

	Lbs.	
Corn fodder	15	Daily roughage
Clover hay	15	
Corn, ground	200	Feed mixture according to production
Oats, ground	300	
Bran	300	
Ground soybeans or Linseed meal	100	

RATION NO. IV

Nutritive ratio 1:6.1

	Lbs.	
Clover hay	20	Daily roughage
Corn, ground	150	Feed mixture according to production
Oats, ground	200	
Bran	200	

RATION NO. V

Nutritive ratio 1:7

	Lbs.	
Prairie hay	20	Daily roughage
Corn, ground	200	Feed mixture according to production
Oats, ground	300	
Bran	300	
Linseed meal	200	

RATION NO. VI

Nutritive ratio 1:6.4 (Using roots to replace silage)

	Lbs.	
Mangle beets (chopped)	35	Daily roughage
Clover hay	12	
Oats, ground	300	Feed mixture according to production
Corn, ground	300	
Bran	300	
Linseed meal	100	

DIGESTIBLE NUTRIENTS IN ONE HUNDRED POUNDS OF COMMON FEEDS*

	Protein	Total nutrients	Dry matter	Nutritive ratio
Concentrates				
Corn, dent, grain only	7.5	85.7	89.5	1:11.4
Corn and cob meal	6.1	78.1	89.6	1:12.8
Gluten meal	30.2	84.0	90.9	1:2.8
Gluten feed	21.6	80.7	91.3	1:3.7
Wheat	9.2	80.1	89.8	1:8.7
Red dog flour	14.8	79.2	88.9	1:5.4
Wheat middlings (shorts)	13.4	69.3	89.5	1:5.2
Wheat bran	12.5	60.9	89.9	1:4.9
Rye	9.9	81.0	90.6	1:8.2
Oats	9.7	70.4	90.8	1:7.3
Barley	9.0	79.4	90.7	1:8.8
Cottonseed meal, choice	37.0	78.2	92.5	1:2.1
Linseed oilmeal, old process	30.2	77.9	90.9	1:2.6
Soybeans, ground	30.7	85.9	90.1	1:2.8
Molasses, cane or black strap	1.0	59.2	74.2	1:59.2
Dry Roughages				
Corn fodder (ears included)	3.0	53.7	81.7	1:17.9
Corn stover (ears removed)	2.1	46.1	81.0	1:22.0
Wheat straw	.7	36.9	91.6	1:52.7
Oat straw	1.0	45.6	88.5	1:45.6
Millet hay (Hungarian)	5.0	55.0	85.7	1:11.0
Mixed grass hay	4.3	51.3	87.2	1:11.9
Prairie hay	4.0	47.9	93.5	1:12.0
Timothy hay	3.0	48.5	88.4	1:16.2
Oat hay	4.5	46.4	88.0	1:10.3
Clover and timothy hay	4.0	46.2	87.8	1:11.5
Oat and pea hay	8.3	48.8	83.4	1:5.9
Alfalfa	10.6	51.6	91.4	1:4.9
Red clover hay	7.6	50.9	87.1	1:6.7
Sweet clover hay	10.9	50.7	91.4	1:4.7
Alsike clover	7.9	47.3	87.7	1:6.0
Cowpea hay	13.1	49.0	90.3	1:3.7
Soybean hay	11.7	53.6	91.4	1:4.6
Dry beet pulp	4.6	71.6	91.8	1:15.6
Succulent Feeds				
Corn silage from mature corn	1.1	17.7	26.3	1:16.1
Corn silage from immature corn	1.0	13.3	21.0	1:13.3
Corn silage from field cured stover	.5	11.3	19.6	1:22.6
Potatoes	1.1	17.1	21.2	1:14.5
Mangles	.8	7.4	9.4	1:8.2

* From "Feeds and Feeding" by Henry and Morrison.

LEGUMES FOR DAIRY COWS

1. Economy of milk production should be the goal.
   a. According to investigations the cost of producing one pound of butterfat ranged in 1921-22 from 12 to 45 cents.
   b. Poor cows and poor feeds run up the cost of production.
2. High priced concentrates must be replaced by home grown feeds.
   a. Oilmeal at $60 per ton may be replaced by soybeans pound for pound.
   b. Bran at $30 is equalled by alfalfa pound for pound.
3. Roughages high in protein and minerals are the cheapest dairy feeds.
   a. Legume roughages are the cheapest feeds that can be grown and fed.
4. The dairy cow is a roughage consumer.
   a. The dairy cow's capacity ranges from 30 to 45 gallons and so demands bulky feed.
5. Legume hays furnish protein at lowest figure.
   a. Protein in alfalfa cost about two-thirds what it cost in bran during 1922-23.
6. Protein is absolutely necessary for body growth and milk production.
   a. The lack of size in the majority of our young stock is due to a lack of protein in their feed.
   b. Casein is the term given to protein in milk. A cow cannot manufacture milk containing protein unless it is fed as required.
7. Legumes are more palatable than prarie or timothy hay and consequently great consumption is assured.
   a. A cow will eat legumes more readily than wild or timothy hay because of the presence of leafy growth which is highly palatable.
8. The less the amount of legumes fed the greater will be the amount of protein concentrates required.
   a. When legume hay is not fed it is usually necessary to feed from one to one and a half pounds of oilmeal per day to a cow producing around 30 pounds of milk to maintain production.
9. Legumes more than cut the oilmeal bill in two.
   a. By cutting down on the oilmeal or cottonseed necessary, legumes tend to make a profit less difficult to accomplish.
10. Concentrated protein supplements such as cottonseed meal and oilmeal may be replaced pound for pound by ground soybeans.
   a. For high producing cows legume hay alone will not furnish sufficient protein, but the soybeans, hulled and ground, are even better pound for pound in the grain ration than oilmeal or cottonseed meal.

References:

Minnesota Institute Annual, Legumes. No. 35, pp. 130-31, 132-37, 138-40, 141-42. 1922.

SILAGE FOR DAIRY CATTLE

Reasons for.—

1. Provides succulence or imitates good pasture condition throughout the winter months.
   a. Helps maintain production.
   b. Stimulates appetite and aids digestion.
   c. Keeps digestive tract in good condition.
2. One acre of corn silage will replace 1½ to 2½ acres fed from the shock. An acre of silage with the grain out is about equal to an acre in the shock with the grain included.

3. Feeds well in mangers; easily available in the winter.
4. Provides a summer reserve for dry years and short pastures, if a little surplus is held over each year. Takes the place of a soiling crop for this purpose.

When to crop.—When the corn is ripe and the lower leaves start to turn. In case of a frost cut at once or the leaves will dry out and fall off. If the stalk is dry add water—plenty of it. It insures good packing and plenty of moisture for fermentation. Silage with the corn grain removed is worth about 61 per cent as much as normal corn silage. (Wisconsin Station)

Soybeans in the silage.—Add considerable protein to the silage but will not add enough to replace a legume hay or to replace high protein grain feeds to any extent.

Sunflower silage.—Yield is high but worth less than corn silage for feed. Some trials show corn silage worth 40 per cent more than sunflower silage. (Montana Station)

Sorghum for silage.—Sorghum cane is valuable silage. Plant in the drier climates. It is practically equal to corn in feeding value. (Kansas Station) Some farmers are mixing it with corn for silage. It may give a greater yield per acre. Try a little of it.

Filling the silo.—See that it is cut fairly fine. Pack and distribute well in the silo to avoid moldy spots.

Feeding silage.—Feed night and morning as much as the cows will clean up well. Feed after milking when market milk is produced. If the silage has a strong odor in a poorly ventilated barn it may even taint the cream if fed before milking.

References:

Henry, W. A.—Feeds and feeding. U. S. Dept. of Agr., Farmers' Bulletin No. 855. Minnesota Extension Bulletin No. 41 (out of print); Special Bulletin No. 43; Experiment Station Bulletin No. 218 and Minnesota Institute Annual No. 35.

MAINTENANCE REQUIREMENTS FOR COWS

(Varies with size of cows)

Cow's weight Lbs.	Protein Lbs.	Total nutrients Lbs.
800	.56	6.34
900	.63	7.13
1,000	.70	7.93
1,100	.77	8.72
1,200	.84	9.51
1,300	.91	10.30
1,400	.98	11.10

REQUIREMENTS FOR MILK PRODUCTION

Requirements vary with the fat and solid content of the milk; 100 pounds of 5 per cent milk requires more feed to produce than 100 pounds of 3 per cent milk.

ADDITIONAL NUTRIENTS REQUIRED FOR MILK*

For each pound of milk testing Per cent	There is required: Protein-about Lbs.	There is required: Total nutrients Lbs.
3	.052	.286
3.5	.055	.316
4	.060	.346
4.5	.063	.376
5	.066	.402
5.5	.070	.428
6	.076	.454

* These figures are only guides and not exact requirements.

NOTES